

# **ISERV**

## ***Pathfinder***



## **The ISS SERVIR Environmental Research and Visualization System**

**Increment 31/32 Science Symposium**

**December 8, 2011**

*Burgess Howell, PI*

*National Space Science and Technology Center, NASA MSFC*



# About SERVIR



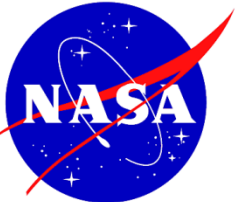
- SERVIR – Spanish for “*to serve*” – is a regional visualization and monitoring system
- SERVIR integrates Earth observations (e.g., space imagery), predictive models, and *in situ* data to provide timely information products to support environmental decision makers.
- SERVIR uses satellite observations, ground-based data, and predictive models to monitor and forecast environmental changes and to improve response to natural disasters.
- SERVIR enables scientists, educators, project managers, and policy implementers to respond better to a range of issues including disaster management, agricultural development, biodiversity conservation, and climate change.



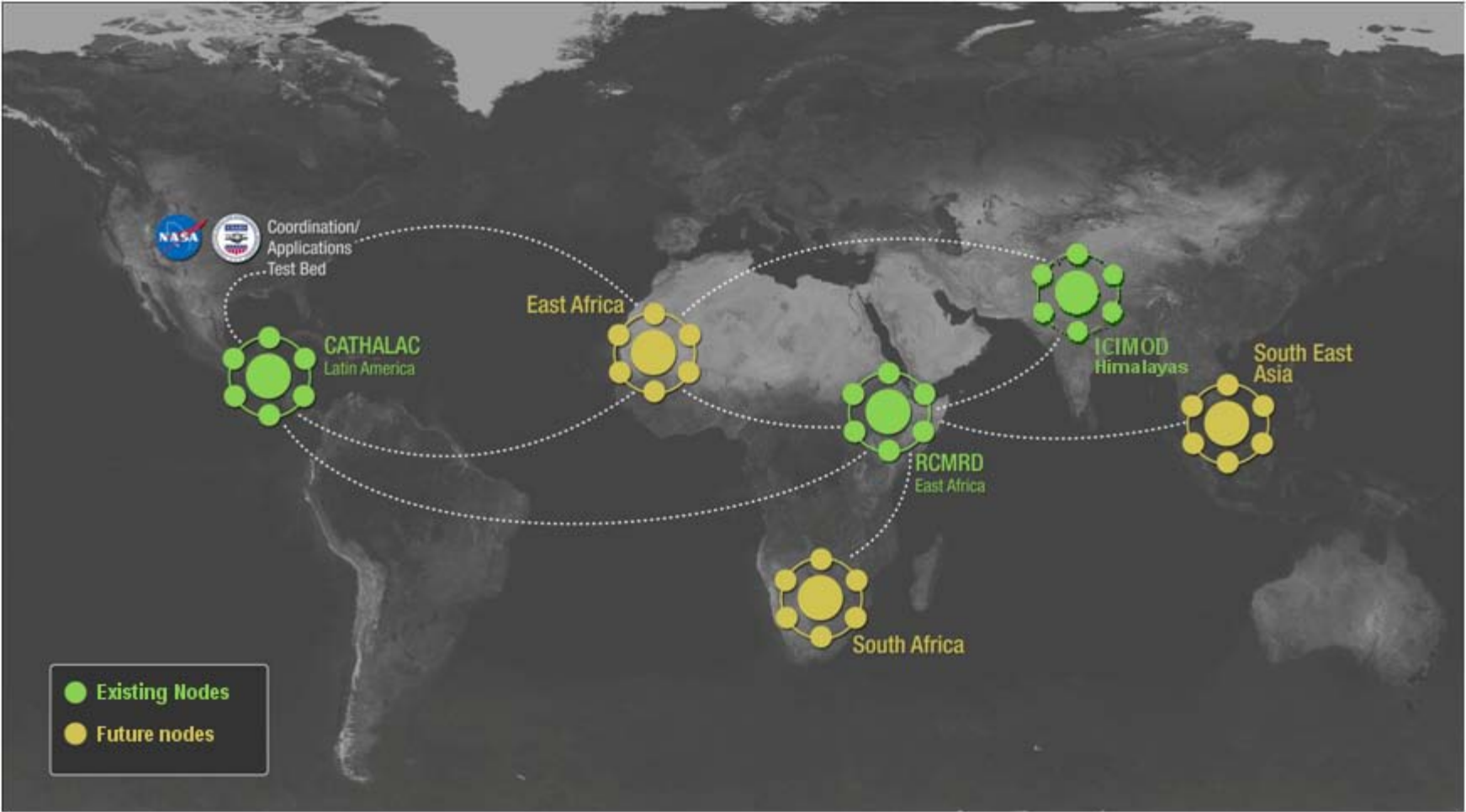
# About SERVIR



- SERVIR is endorsed by governments of Central America, Africa, and Asia, and principally supported by NASA and the US Agency for International Development (USAID); a strong emphasis is placed on partnerships to fortify the availability of searchable and viewable Earth observations, measurements, visualizations, and analysis.
- The SERVIR coordination office and rapid prototyping facility are located at the NASA Marshall Space Flight Center in Huntsville, Alabama. Regional SERVIR hubs are located at the Water Center for the Humid Tropics of Latin America and the Caribbean (CATHALAC) in Panama, the Regional Center for Mapping of Resources for Development (RCMRD) in Kenya, and the International Centre for Integrated Mountain Development (ICIMOD) in Nepal.



# SERVIR Global Network



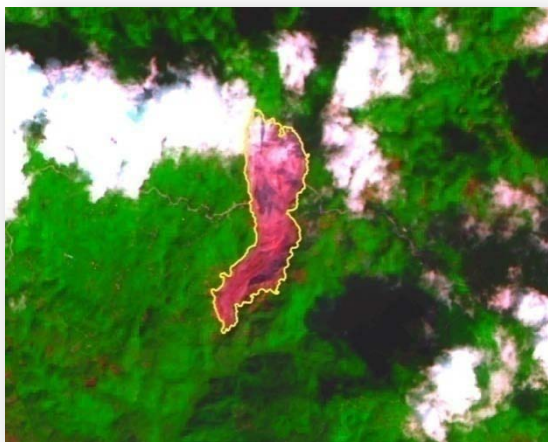
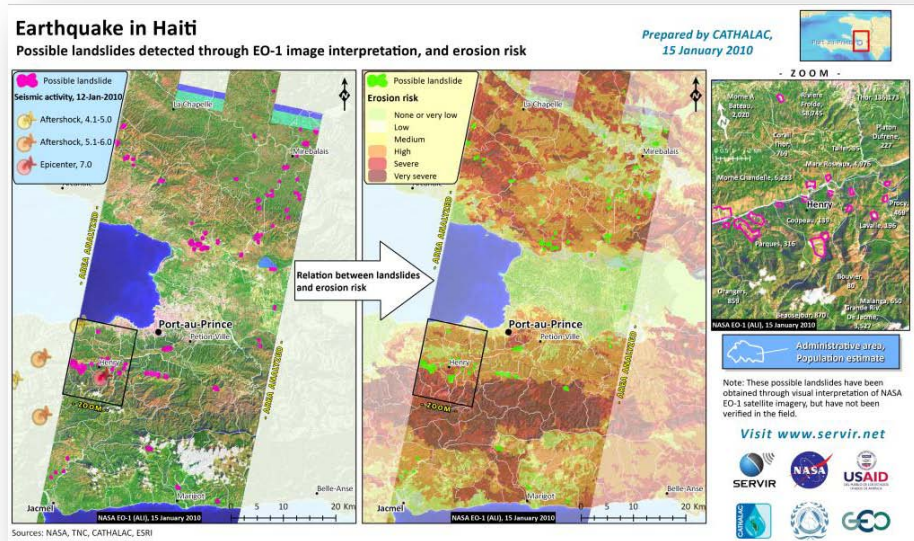




# SERVIR Applications



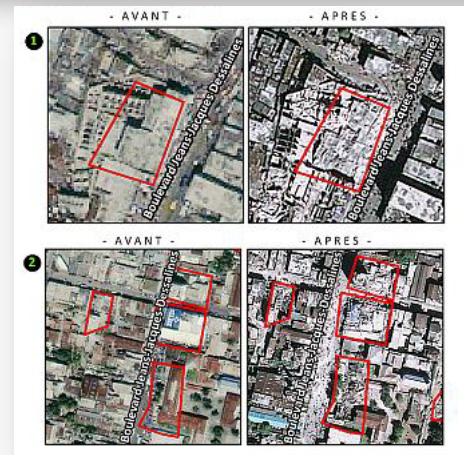
- Environmental Monitoring
- Air Quality and Public Health
- Climate Change and Biodiversity
- Short Term Weather Prediction
- Disaster Monitoring and Assessment



Mapping Landslide in Guatemala  
January 2009



Fires in Guatemala and Mexico  
April 2009



Damage/Landslide in Haiti  
January 2010



# SERVIR Concept of Operations



- SERVIR uses a variety of Earth observation satellite data sources.
- SERVIR provides various products to support environmental decisions, disaster response, and other societal benefit areas.
- In emergencies, SERVIR must task commercial and public data sources (including NASA) to monitor and assess disasters.
- **SERVIR controls no physical assets for data acquisition.**

***This is what keeps us up nights!!!***



# ISERV Development

## *A Symphony in 4 Movements*



- **ISERV-W: Internal Visible/Near-Infrared (VNIR)**

- Attached to ISS via WORF  
using 3-axis gimbaled mount
- Pointing utilizing INS stream
- High spatial resolution
- Moderate spectral range



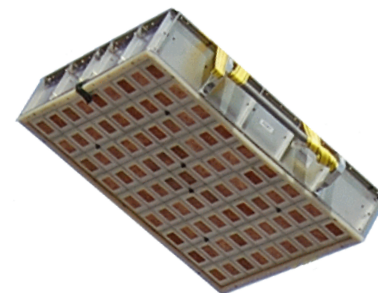
- **ISERV-E: External Visible/Broad-Infrared (V/IR)**

- Attached to ISS via fixed mount on  
existing external attachment locations
- Enhanced spatial resolution
- Extended spectral range
- Enhanced pointing
- Capable of tracking targets



- **ISERV-PM: External Passive Microwave**

- L-band / C-band / Ku-band Phased Array
- Attached to ISS via fixed mount on existing  
external attachment locations
- 100m<sup>2</sup> array of multi-frequency sensors



# ISERV-W1



- Quickly meets SERVIR core needs

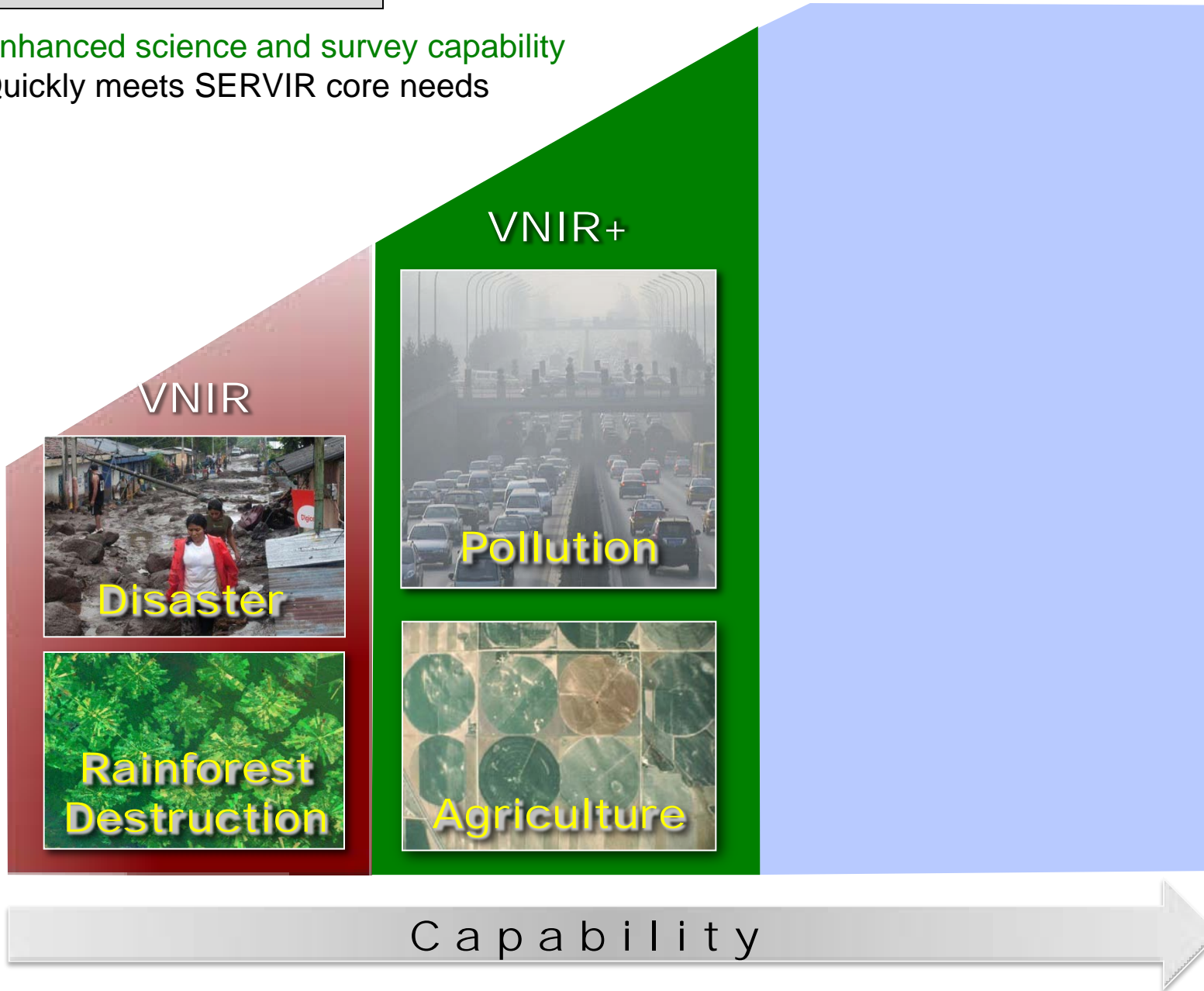




# ISERV-W2



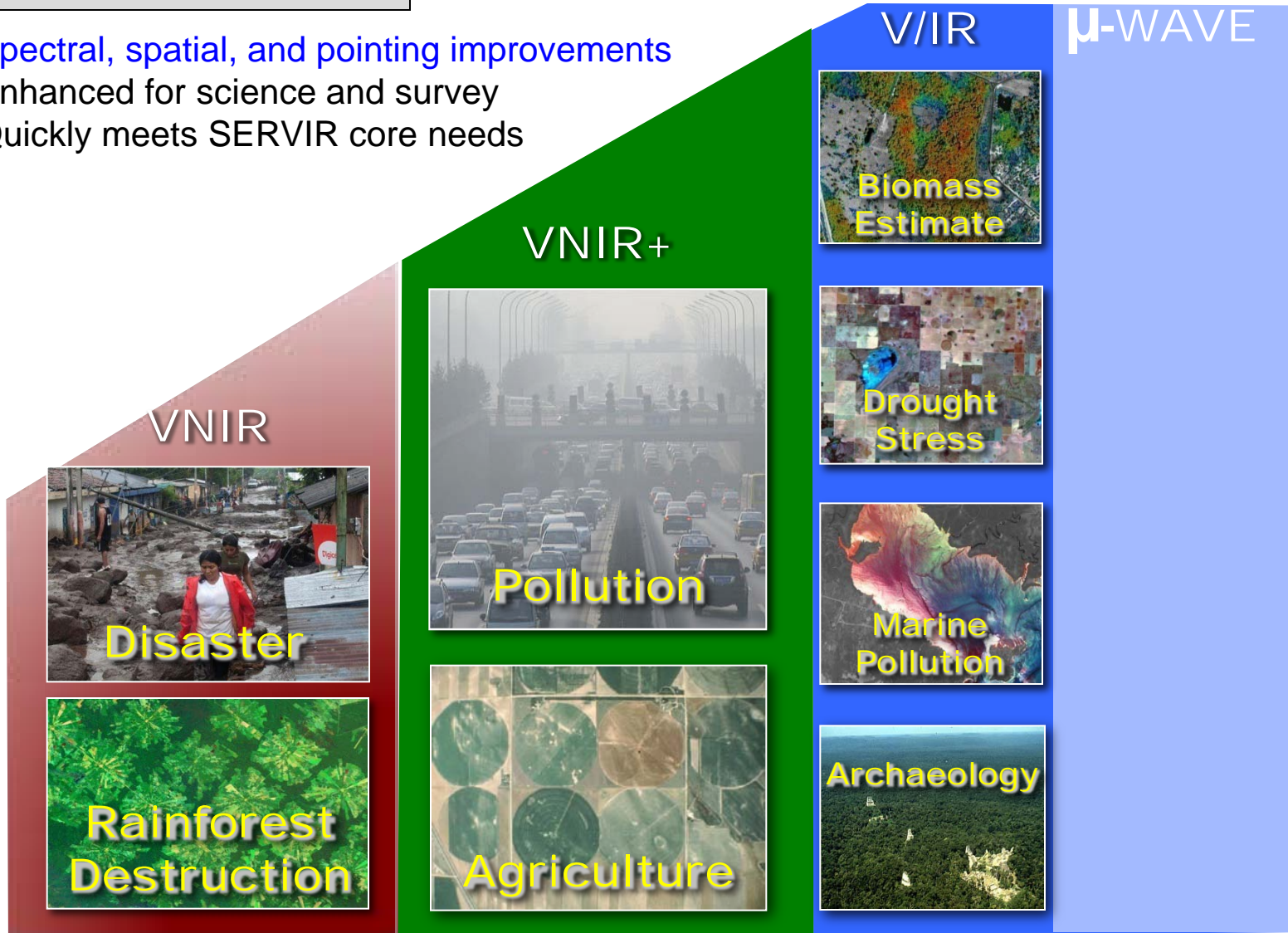
- Enhanced science and survey capability
- Quickly meets SERVIR core needs



# ISERV-E



- Spectral, spatial, and pointing improvements
- Enhanced for science and survey
- Quickly meets SERVIR core needs



Science

Capability



# ISERV-PM



- Multiband array addresses core science needs
- Spectral, spatial, and pointing improvements
- Enhanced for science and survey
- Quickly meets SERVIR core needs

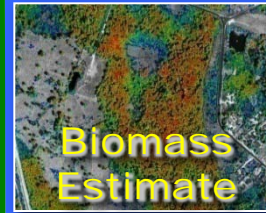
VNIR



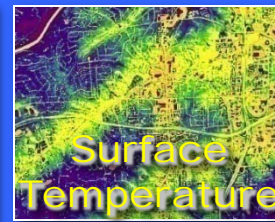
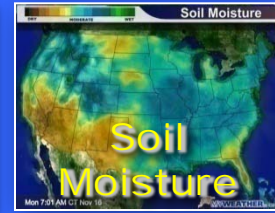
VNIR+



V/IR



$\mu$ -WAVE



Science

Capability



# A Pathfinder for SERVIR & ISS

## *Prelude*



As a preliminary step, we are deploying a *Pathfinder* imaging system for developmental testing in WOF to:

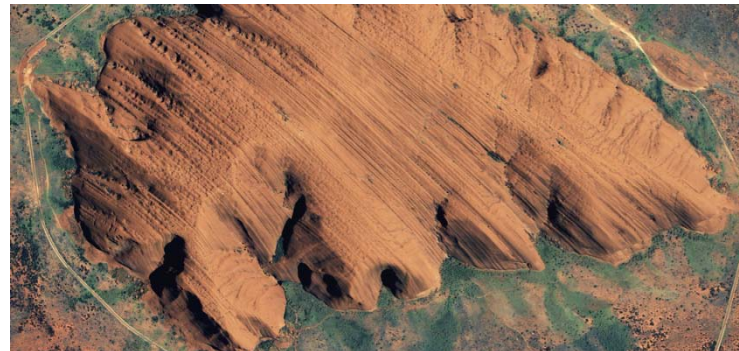
- **Develop general tasking, utilization, ground command, data acquisition, and processing experience**
- **Develop image acquisition, processing, and analysis capabilities**
- **Develop full command / acquisition / processing operations capabilities for ISERV humanitarian aid & disaster monitoring and assessment operational requirements.**
- **Inform the definition of requirements for an operational external ISERV Imaging System**



# What Do We Expect?



- The primary result of ISERV Pathfinder will be operational experience to inform and improve the design of an operational, external SERVIR imaging system.
- Low-cost Pathfinder testing will buy down programmatic and technical risk with the eventual operational, external SERVIR imaging system.
- We do anticipate acquiring images with utility for humanitarian assistance and Earth science applications.



**"We even have visions of putting an instrument aboard the International Space Station that would help us with SERVIR, that would widen and increase our ability to provide even more data to the decision makers and the like."**

Administrator Charlie Bolden at the MSFC All-hands  
November 16, 2010





# I/SERV Pathfinder Telescope Assembly



**Celestron CPC925 9.25”  
Schmidt-Cassegrain Telescope  
On Alt-Az Mount**



**Canon EOS 7D Digital  
Single Lens Reflex (DSLR)  
Camera**



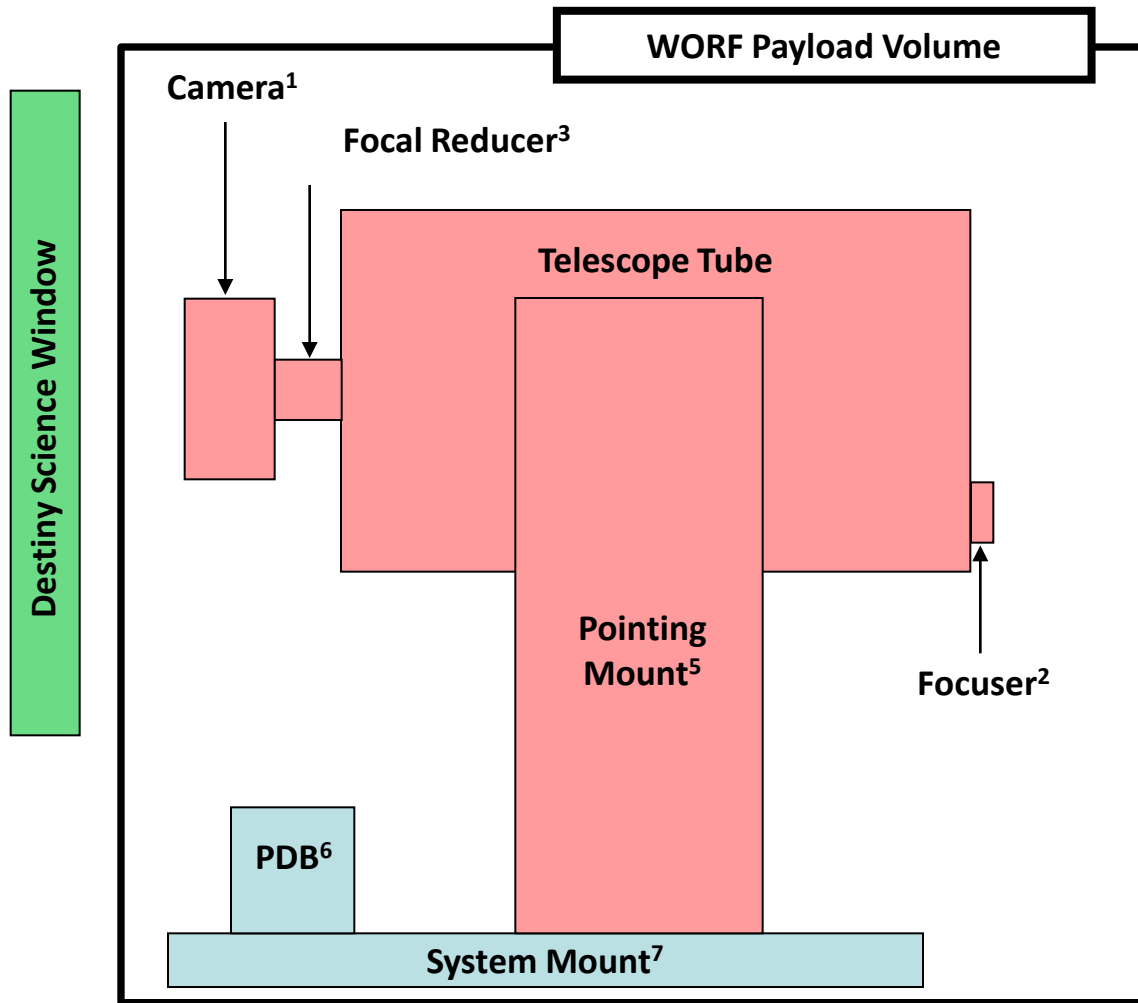
**Starizona HyperStar  
Focal Reducer**

## Optical Performance

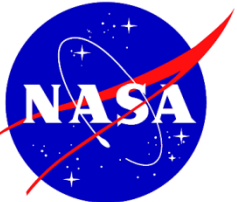
@ 350 km altitude	Angular	Spatial
Resolution	1.65 arcsec	2.8 m
FOV	2.36° x 1.58 °	~13 km x ~9 km
Spectral	350nm to 800 nm	



# ISERV Pathfinder Imaging System



1. Canon EOS 7D
2. Starlight Instruments Microfocuser
3. Starizona Hyperstar Focal Reducer
4. Celestron 925 CPC Schmidt-Cassegrain Telescope Tube
5. Celestron 800 CPC Pointing Mount, modified for 925 Tube
6. Power Distribution Box (PDB)
7. System Mount



# ISERV Optical System and Pointing Mount



Canon EOS 7D  
DSLR Camera Body

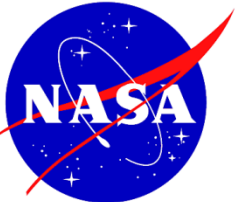


Celestron CPC 925  
Telescope Tube

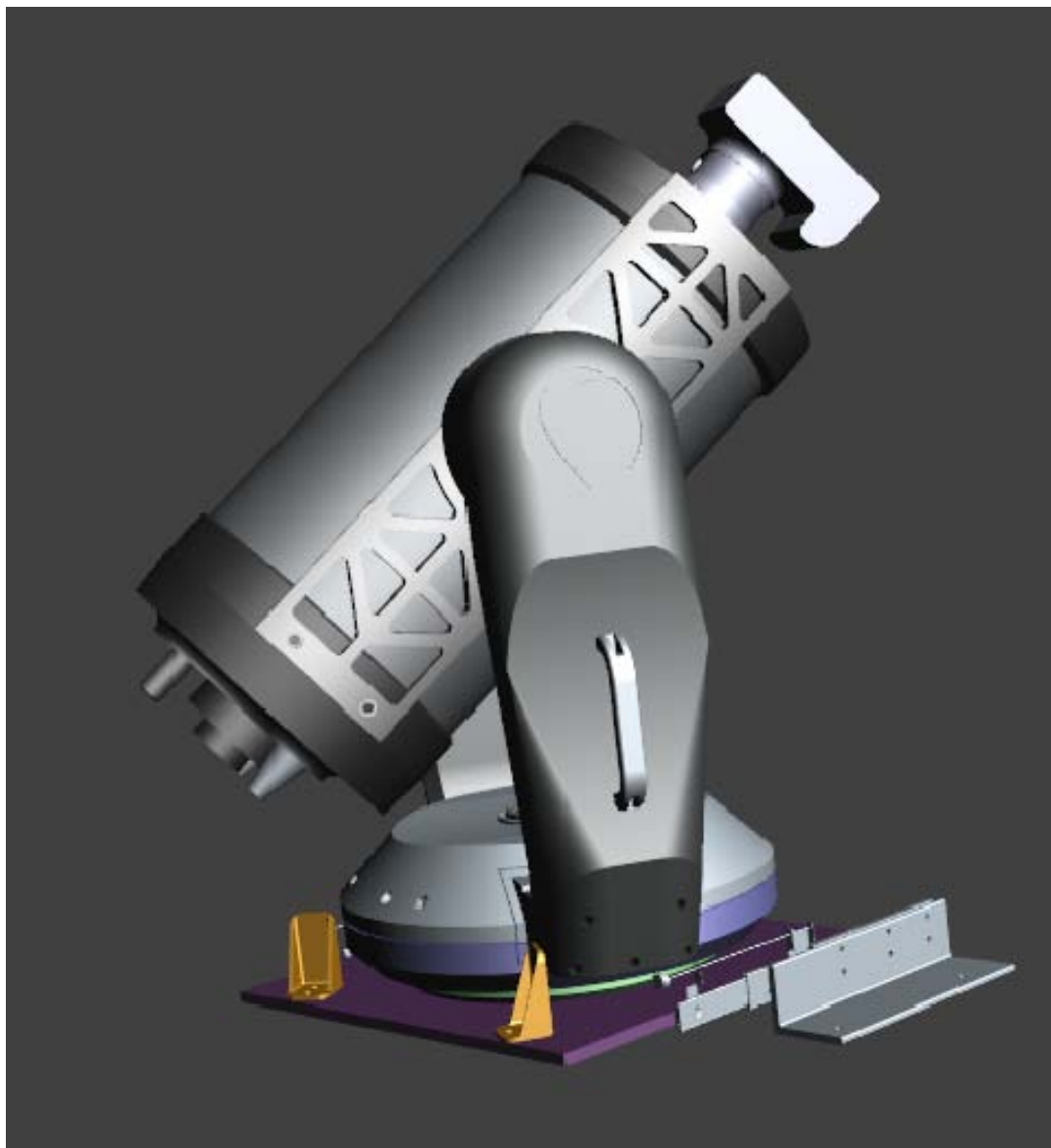
Celestron 800 CPC  
Pointing Mount,  
modified to  
accommodate 925  
Telescope Tube

HyperStar Focal  
Reducer

Not shown:  
Starlight Instruments  
Feathertouch  
Microfocuser



# Current Hardware Configuration

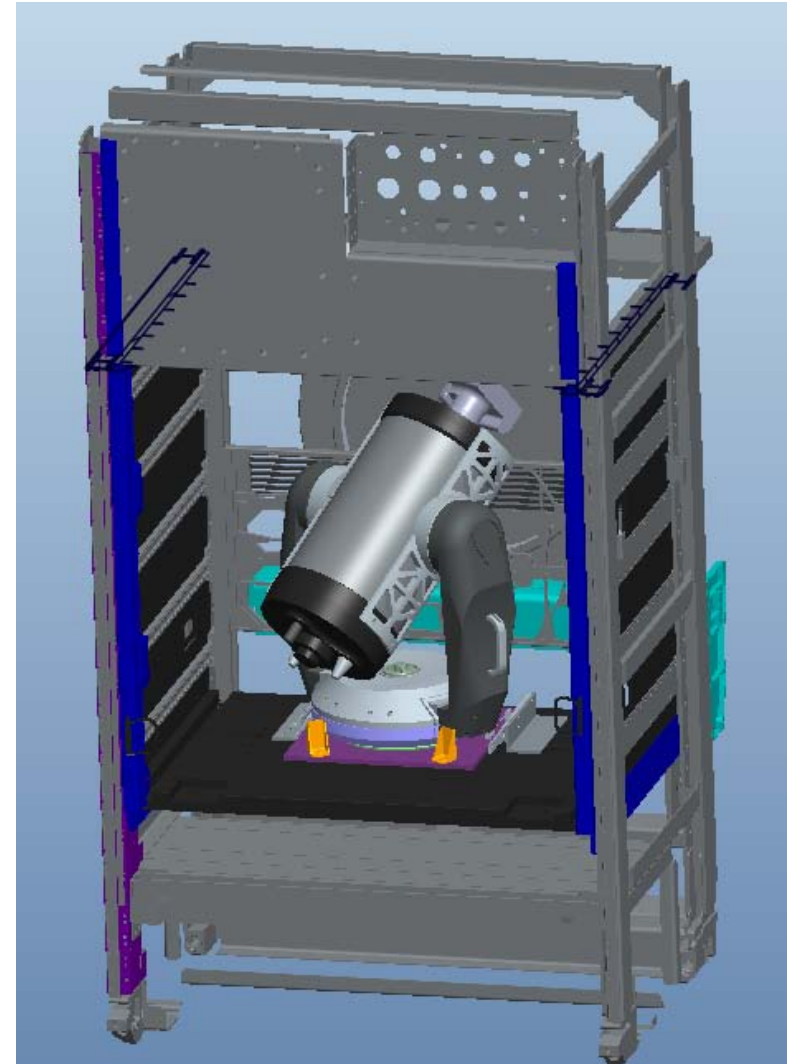




# ISERV in WORF - Parked Position



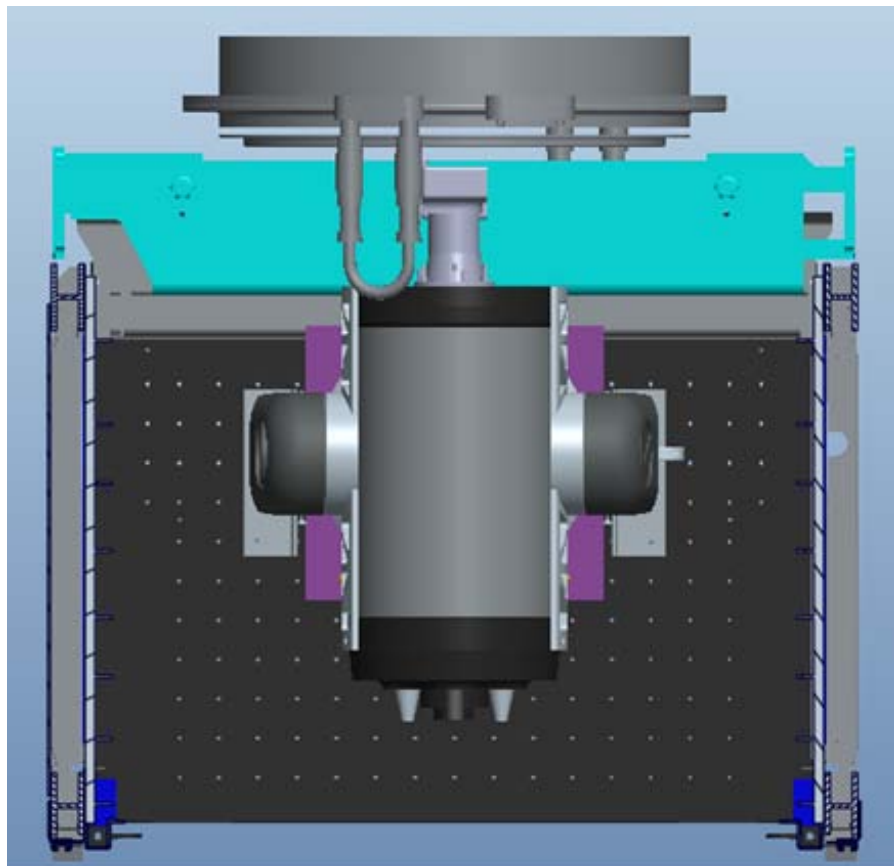
- Telescope and pointing mount are slid back toward the WORF hatch to clear bump shield
- Telescope base is rotated clockwise to the stop
- Telescope, focal reducer, and camera are rotated up to clear bump shield





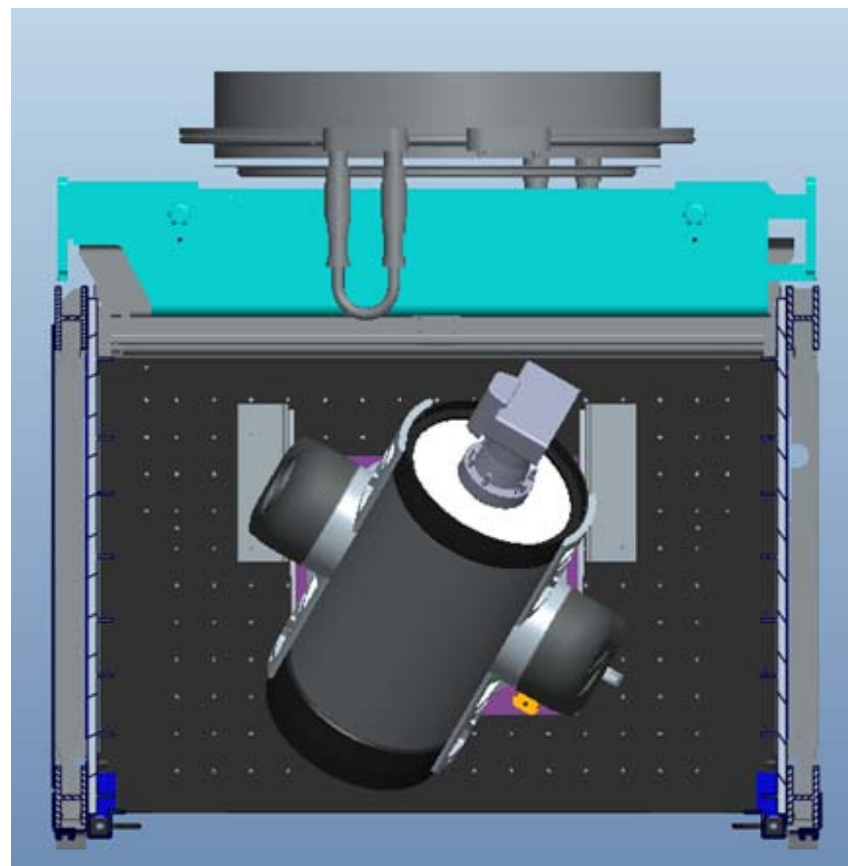


# Overhead Views



## Active

(bump shield lowered,  
system slid toward window)



## Parked

(bump shield raised,  
system slid retracted from window)



# ISERV Current Status



- Hardware fabrication complete
- Flight system assembly complete
- Undergoing testing at MSFC
- On dock delivery to JSC January 12, 2012
- Manifested on HTV3
- Launch scheduled June 26, 2012
- Installation in WOLF July 2012
- Operational July or November 2012

